Patent claims

1. An optical semiconductor device with a multiple quantum well structure, in which well layers and barrier layers comprising various types of semiconductor layers are alternately layered, in which device well layers (6a) of a first composition based on a nitride semiconductor material with a first electron energy and barrier layers (6b) of a second composition of a nitride semiconductor material with electron energy which is higher in comparison with the first electron energy are provided, followed, seen in the direction of growth, by a radiation-active quantum well layer (6c), for which the essentially non-radiating well layers (6a) and the barrier layers (6b) arranged in front form a superlattice.

2. The optical semiconductor device as claimed in patent claim 1, in which the well layers (6a) are thin aluminum-indium-gallium-nitride layers and the barrier layers (6b) are gallium-nitride or aluminum-gallium-nitride layers which are thicker in comparison and the radiation-active quantum well (6c) is an indium-gallium-nitride layer.

3. The optical semiconductor device as claimed in patent claim 1 or 2, in which the radiation-active quantum well (6c) follows the uppermost barrier layer (6b).

4. The optical semiconductor device as claimed in one of patent claims 1 to 3, in which the layer thickness of the radiation-active quantum well (6c) is greater than the layer thickness of the well layers (6a) of the superlattice.

5. The optical semiconductor device as claimed in one

of patent claims 1 to 4, in which the well layers (6a) are thinner than 2 nm and the barrier layers (6b) are 3 nm thick or thicker.

6. The optical semiconductor device as claimed in one of patent claims 2 to 5, in which the well and barrier layers (6a, 6b) are doped with silicon.

7. The optical semiconductor device as claimed in patent claim 6, in which the dopant concentration is from 10^{17} to 10^{18} cm^{-3}.

8. The optical semiconductor device as claimed in one of patent claims 1 to 7, in which, within at least one well layer (6a) of the superlattice, the In content increases in the direction of growth, i.e. in the direction of the radiation-active quantum well layer (6c).

9. The optical semiconductor device as claimed in claim 8, in which, in the well layer (6a), the indium content remote from the radiation-active quantum well layer lies below 5%.

10. The optical semiconductor device as claimed in one of patent claims 1 to 7, in which at least one of the well layers (6a) of the superlattice has at least one pair of single layers (60a, 61a), of which the first single layer (60a) in the direction of growth has a lower indium content than the second single layer (61a) in the direction of growth.

11. The optical semiconductor device as claimed in claim 10, in which the second single layer (61a) has an indium content higher by less than 5% than the first single layer (60a).

12. The optical semiconductor device as claimed in claim 10 or 11, in which the well layer has a plurality of single layers (60a, 61a, 62a, 63a) whose indium content increases step by step from the single layer (60a) lying furthest away from the radiation-active quantum well layer (6c) to the single layer (63a) lying closest to the radiation-active quantum well layer (6c).

13. The optical semiconductor device as claimed in claim 12, in which the steps of the increase in the indium content are smaller than 5%.

14. The optical semiconductor device as claimed in one of claims 10 to 13, in which the indium content of the single layer (60a) lying furthest away from the radiation-active quantum well layer (6c) is less than 5%.

15. The optical semiconductor device as claimed in one of claims 10 to 14, in which the thickness of each of the single layers (60a, 61a, 62a, 63a) lies in the range of just a few monolayers or corresponds approximately to one monolayer.